



Universal Counter type U21005 (w/GM)



User's Manual Version 1.00 English

Overview

3B Scientific Universal Counter type U21005 is a microprocessor based Counter. Specially designed for the education in Physics.

The instrument has the following functions and measuring modes:

- * Frequency counting Continuous measurement
 Single measurement
 Pendulum - continuous measurement
 Pendulum - single measurement
- * Period measurement Continuous measurement
 Single measurement
 Pendulum - continuous measurement
 Pendulum - single measurement
- * Impulse counting Continuous counting
 Counting for 1 second
 Counting for 6 seconds
 Counting for 10 seconds
 Counting for 60 seconds
 Counting for 10 seconds, followed by 5 seconds' pause
 Counting for 10 seconds, continuous.
- * Start A - Stop B The time interval from A to B is measured
 (positive- or negative-going pulses selectable on both input A and B)
- * Pass times Measures the pass times for A and B (up to 9 per channel)
 (high-level or low-level selectable on both input A and B)
- * Run + Pass times Measures the time from A to B and the pass times for A and B.
 (positive-/high-level or negative-/low-level selectable on both input A and B)

The U21005 can be used as a stand-alone instrument or together with a Personal Computer. A Windows program for operation and data logging from the instrument is supplied with the instrument. Also a cable for connecting the U21005 and the PC serial port (COM-1 or COM-2) is supplied.

The Geiger-Müller amplifier module is as standard supplied with the U21005.

OPERATION



Fig. 1. Overview of the counter U21005

FRONT PANEL



POWER On / Off contact.

FUNCTION Push button for selection of function. Push to select next function.

SELECT Push button for selection of measuring method, and for use with display of results.

START/STOP Push button to start and stop of measurement.

Hz Light emitting diode (LED) for indication of measurement in Hz

kHz Light emitting diode (LED) for indication of measurement in kHz

s Light emitting diode (LED) for indication of measurement in seconds

ms Light emitting diode (LED) for indication of measurement in msec

Display 4-digit LED-display for results

Display 2x16-character LCD-display for function, selection, setup etc.

A Input A light emitting diode

B Input B light emitting diode

IMPULSE Electrical impulse input A.

IMPULSE Electrical impulse input B

SWITCH Electro/mechanical switch input A

SWITCH Electro/mechanical switch input B

PHOTO/MIC. DIN socket for connection of photo gates or microphone.

PHOTO/MIC. DIN socket for connection of photo gates or microphone.

REAR PANEL

POWER 230 V AC 230 V AC 50-60 Hz mains.

FUSE Mains fuse for instrument. (0,5 AT).

RS232 INTERFACE RS232 interface to PC.

GM - OPTION

GM BNC-bushing. Connection for Geiger-Müller tube.

GM Voltage regulation potmeter for the Geiger-Müller tube.

Instructions for use.

The instrument is powered by activating the switch marked '**POWER**'.

Immediately on power-on the instrument displays the version number (i.e. '**R 1.00**' for approx. 2 secs.).

The counter is now ready for use.

The selected function and method of measurement are shown in the LCD-display.

To change language turn off the power, hold the '**SELECT**' and simultaneous switch on the power.

Use the '**SELECT**' button to change the language, press '**FUNCTION**' to store the selection in memory.

Select a function with the push-button '**FUNCTION**' and then the measuring method with the push-button '**SELECT**'. If the selected function has the option to select the trigger polarity, then a simultaneous push on '**FUNCTION**' and '**SELECT**' displays the trigger polarity in the LCD-display for each input. Pushing the '**SELECT**' changes the trigger polarity. Push the '**START/STOP**' to store the selection in memory.

List of the functions and measurement methods:

Function	Select	Description
FREQUENCY	Continuous	When ' START/STOP ' is pressed, frequency is continuously measured.
	Single measuring	When ' START/STOP ' is pressed, a single measurement is started.
	Pendulum Cont.	When ' START/STOP ' is pressed, a pendulum's freq. is continuously measured.
	Pendulum Single	When ' START/STOP ' is pressed, a single measurement is started.
PERIODES	Continuous	When ' START/STOP ' is pressed, the period time is measured continuously.
	Singe measuring	When ' START/STOP ' is pressed twice, a single measurement is started.
	Pendulum Cont.	When ' START/STOP ' is pressed, a pendulum's period time is cont. measured.
	Pendulum Single	When ' START/STOP ' is pressed, a single measurement is started.
IMPULSE COUNT		
	Continuous Count	When ' START/STOP ' is pressed, the impulse counting is started, and runs until ' START/STOP ' is pressed again.
	1 sec. Counting	When ' START/STOP ' is pressed, counting for 1 sec is started.
	6 sec. Counting	When ' START/STOP ' is pressed, counting for 6 sec is started.
	10 sec. Counting	When ' START/STOP ' is pressed, counting for 10 sec is started.
	60 sec. Counting	When ' START/STOP ' is pressed, counting for 60 sec is started.
	Count. 10s-Hold 5s	When ' START/STOP ' is pressed, counting for 10 sec is started followed by 5 sec pause.
	10s Continuous	When ' START/STOP ' is pressed, sequential counting for 10 sec is started.

At frequency, period and impulse measurements, only input A is used.

START A - STOP B

[START]

When '**START/STOP**' is pressed, the time from A to B is measured.

PASS TIME

[START]

When '**START/STOP**' is pressed, pass times on A and B are measured (Up to 9 measurements per channel).

RUN & PASS TIME

[START]

When '**START/STOP**' is pressed, the run time from A to B, and the pass time for A and B are measured.

On the each of the above three functions (and the pendulum selection in frequency and period), the following applies:

When '**FUNCTION**' and '**SELECT**' are pressed simultaneously, the start-/stop-polarity triggering is shown on the display.

Pressing '**SELECT**' shifts through the four (two) different combinations possible.

Press '**START/STOP**' to store the selection in memory for each individual function. The setup is memorized, even when the power is off.

Frequency measurement

Select frequency measuring with the push-button '**FUNCTION**' and hereafter the wanted measuring function with the push-button '**SELECT**'.

Press the button '**START/STOP**' to start the frequency measurement.

If the measuring function 'Single measuring' or 'Pendulum Single ' (pendulum), has been selected, a new frequency measurement is made every time the push-button '**START/STOP**' is pressed.

LED '**Input A**' is lit when the input (the gate) is open.

Selection of trigger polarity is possible, if pendulum is selected.

The frequency is displayed in Hz or kHz.

Period measurement

Select period measuring with the push-button '**FUNCTION**' and hereafter the wanted measuring function with the push-button '**SELECT**'.

Press the button '**START/STOP**' to start the period measurement.

If the measuring function 'Single measuring' or 'Pendulum Single ' (pendulum), has been selected, a new period measurement is made, every time the push-button '**START/STOP**' is pressed.

Selection of trigger polarity is possible, if pendulum is selected.

LED '**Input A**' is lit when the input (the gate) is open.

The period time is displayed in sec or msec.

Impulse counting

Select impulse counting with the push-button '**FUNCTION**' and hereafter the wanted counting functions with the push-button '**SELECT**'.

At all counting functions, the '**Input A**'-LED is lit when counting.

If 'Continuous' has been selected, the counter is started when '**START/STOP**' is pressed. The counter can be stopped and restarted (without resetting the counter) by pressing the '**START/STOP**'.

If the counter has to be reset (count set to zero): push '**START/STOP**' to stop the counting, and thereafter push '**FUNCTION**' to reset and prepare the counter for a new counting.

If count time has been selected to 1, 6, 10 or 60 seconds (1 s / 6 s / 10 s / 60 s), a new counting time is started by pressing '**START/STOP**'. The counter can not be restarted if a count is in progress.

If 'Count. 10s-Hold 5s' has been selected, the counter is started when '**START/STOP**' is pressed. Counting is done in segments of 10 seconds with a 5 seconds' interval pause. The counter is reset before each 10 seconds' counting.

The function is stopped when '**FUNCTION**' is pressed, and the counter is then reset and prepared for a new measurement.

If '10s Continuous' has been selected, the counter is started when '**START/STOP**' is pressed.

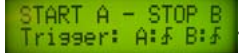
The counting sequence is continuous, with 10 seconds' counting followed by a 5 seconds' display-lock (for reading the result). The counter is reset (and restarted) every 10 seconds, even if the *display* is locked (the counter is still counting).

The function is stopped when '**FUNCTION**' is pressed, and the counter is reset and prepared for a new measurement.

Start A - Stop B

The function is selected with the push-button '**FUNCTION**', and started when '**START/STOP**' is pressed.

The time measurement starts when an impulse occurs at input **A**, and stops when an impulse occurs at input **B**. The time is displayed in μsec / msec .

The positive- or negative-going triggering is setup by pressing '**SELECT**' and '**FUNCTION**' simultaneously. The current state of the setup is shown in the display i.e. . Pressing '**SELECT**' shifts through the four different combinations. When satisfied, press '**START/STOP**' and the setup is stored in the internal Lithium Battery backup-memory.

The LEDs '**Input A**' and '**Input B**' are lit until an impulse has occurred at each input. When the measurement is stopped, a new measurement is prepared when '**START/STOP**' is pressed.

The function is aborted if '**FUNCTION**' is pressed again, and the counter is reset and prepared for a new measurement.

Pass times A and B

The function is selected with the push-button '**FUNCTION**', and started when '**START/STOP**' is pressed.

The positive- or negative-level counting is setup by pressing '**SELECT**' and '**FUNCTION**' simultaneously. The current state of the setup is shown in the display i.e. . Pressing '**SELECT**' shifts through the four different combinations. When satisfied, press '**START/STOP**' and the setup is stored in the internal Lithium Battery backup-memory.

The LEDs '**Input A**' and '**Input B**' are lit.

The pass times on '**Input A**' and '**Input B**' are measured independent from each other. During passage of **A** and **B**, the light emitting diode at '**Input A**' or '**Input B**' is turned off.

The number of pass times on each input is constantly shown in the display : '**2 4**' indicates 2 pass times on **A** and 4 on **B**.

The counter's memory holds up to 9 pass times per input.

When no more measurements are needed, press '**START/STOP**' once and the light emitting diodes '**Input A**' and '**Input B**' are turned off.

Each time the push-button '**SELECT**' is pressed, the measurements are read out one by one. The measurements are numbered A1-9 or B1-9.

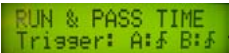
The readings are in sec or msec

All measurements must be read at least once, before new measurements can be started by pressing the '**START/STOP**' push-button.

Note: When 'FUNCTION**' is pressed, all measurements are deleted, and the counter is prepared for new measurements.**

Run and Pass times

The function is selected with the push-button '**FUNCTION**', and started when '**START/STOP**' is pressed.

The positive- or negative-level counting is setup by pressing '**SELECT**' and '**FUNCTION**' simultaneously. The current state of the setup is shown in the display i.e. . Pressing '**SELECT**' shifts through the four different combinations. When satisfied, press '**START/STOP**' and the setup is stored in the internal Lithium Battery backup-memory.

The LEDs '**Input A**' and '**Input B**' are lit.

The pass times on '**Input A**' and '**Input B**' are measured together with the run time (the time from **A** to **B**). During passage of **A** and **B**, the light emitting diode at '**Input A**' and '**Input B**' are turned off.

A must be passed before **B**.

If **A** is passed several times before **B**, the time in memory is the *first* passage of **A**.

The light emitting diodes '**Input A**' and '**Input B**' are turned off, and the Run Time is displayed.

When the push-button '**SELECT**' is pressed, the Pass Time A is displayed, and another push on '**SELECT**' displays the Pass Time B.

If '**SELECT**' is pressed again, the display sequence is repeated.
Display time unit is sec or msec.

All three measurements must have been read *at least on time*, before a new measurement can be started by pressing '**START/STOP**' .

Note: Pressing '**FUNCTION**' will delete all results, and the counter is prepared for new measurements.

Option

Geiger-Müller amplifier module

As standard the optional Geiger-Müller amplifier module is installed in the U21005, and the number of measurement functions in **IMPULSE COUNT** are expanded as follows:

Function	Select	Description
IMPULSE COUNT		
	Continuous Count	When ' START/STOP ' is pressed, the impulse counting is started, and runs until ' START/STOP ' is pressed again.
	1 sec. Counting	When ' START/STOP ' is pressed, counting for 1 sec is started.
	6 sec. Counting	When ' START/STOP ' is pressed, counting for 6 sec is started.
	10 sec. Counting	When ' START/STOP ' is pressed, counting for 10 sec is started.
	60 sec. Counting	When ' START/STOP ' is pressed, counting for 60 sec is started.
	Count. 10s-Hold 5s	When ' START/STOP ' is pressed, counting for 10 sec is started followed by 5 sec pause.
	10s Continuous	When ' START/STOP ' is pressed, sequential counting for 10 sec is started.
IMPULSE COUNT GM		
	Continuous Count	When ' START/STOP ' is pressed, the GM-input counting is started, and runs until ' START/STOP ' is pressed again.
	1 sec. Counting	When ' START/STOP ' is pressed, GM-input counting for 1 sec is started.
	6 sec. Counting	When ' START/STOP ' is pressed, GM-input counting for 6 sec is started.
	10 sec. Counting	When ' START/STOP ' is pressed, GM-input counting for 10 sec is started.
	60 sec. Counting	When ' START/STOP ' is pressed, GM-input counting for 60 sec is started.
	Count. 10s-Hold 5s	When ' START/STOP ' is pressed, GM-input counting for 10 sec is started followed by 5 sec pause.
	10s Continuous	When ' START/STOP ' is pressed, sequential GM-input counting for 10 sec is started.

Geiger-Müller tube is connected to the BNC-plug marked 'GM' at the rear panel of the counter.

The GM Voltage is adjusted with the knob '**GM Voltage**', at the rear panel of the counter.

Selecting the function '**IMPULSE COUNT GM**', the GM input at the rear panel of the counter is used as the only signal input source.

Description of the methods and how to use the function, please consult the section '**Impulse Count**' as the methods are the same.

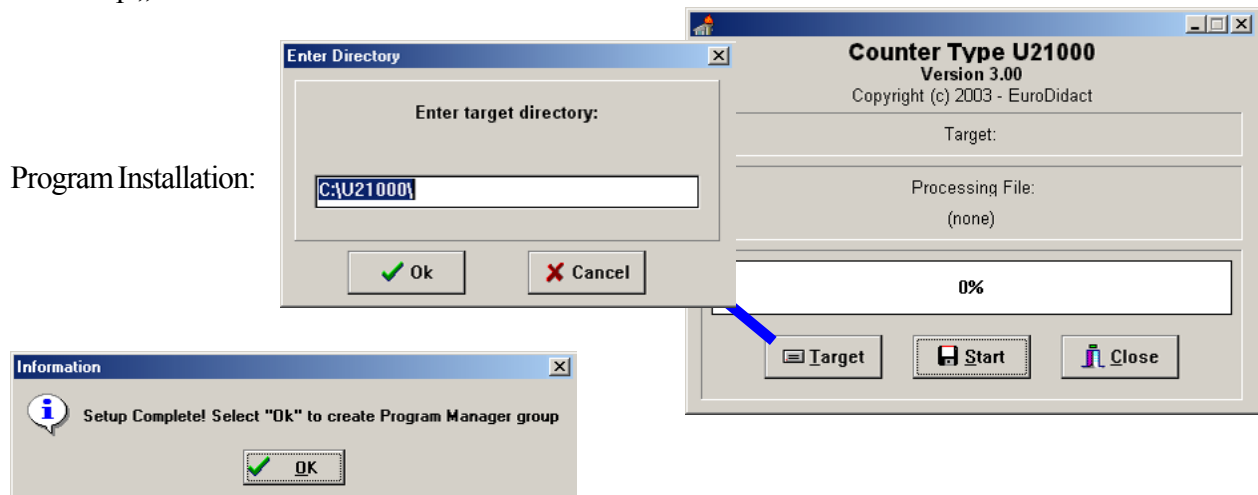
PC program U21005

Installation

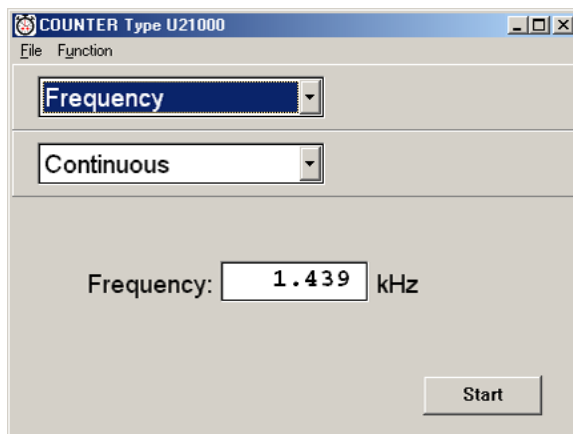
Insert the CDROM in drive. From Windows, run the program <D:3B Scientific/U21005 PC-software/SETUP.EXE>. Click the „Target“-button to select where you want to install the program (e.g.: C:\U21005\).

Start the installation with the „Start“-button. The program is then installed on your hard disk and the Group „3B Scientific“ is added.

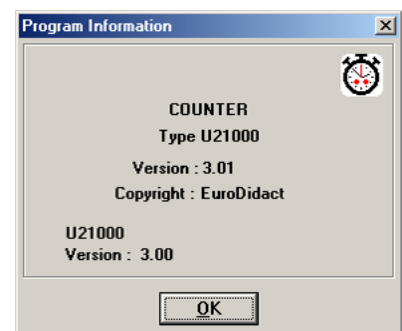
Program Installation:



Start the program „U21005“ in the group „3B Scientific“, and select the ComPort from the File pull down menu, used to connect to the Counter U21005. When the Counter U21005 has been correct connected **with the supplied cable**, the program automatically displays the current function set on the counter. See the example below.



Use <File>, <Program information> to display this window:



In the pull-down menu “**File**” the following is available:

ComPort	Selection of the PC’s Serial port (COM-1 or COM-2).
U21005 setup	Data flow Selection of Start/Stop or Continuous data flow from the counter to the PC. Only active during IMPULSE COUNT and START A - STOP B . Language Select the language.
Program Information	Displays the version of the program etc. If a counter U21005 is connected, the version of the instrument is also displayed.
Exit	Exit program.

In the menu “**Function**” the following can be selected:

Frequency	Continuous	Continuous frequency counting.
	Single Measurement	Click ‘ Start ’ for one single measurement.
	Pendulum Continuous	Continuous measurement of the frequency of a Pendulum.
	Pendulum Single Meas.	Click ‘ Start ’ for one single measurement of the frequency of a pendulum.
Period	Continuous	Continuous period counting.
	Single Measurement	Click ‘ Start ’ for one single measurement.
	Pendulum Continuous	Continuous measurement of the pendulum time.
	Pendulum Single Meas.	Click ‘ Start ’ for one single measurement of the period time of a pendulum.

Impulse Count	Continuous	F1 Continuous impulse counting.
	1 sec	F2 Impulse counting for 1 sec
	6 sec	F3 Impulse counting for 6 sec
	10 sec	F4 Impulse counting for 10 sec
	60 sec	F5 Impulse counting for 60 sec
	10 sec + 5 sec Pause	F6 Impulse counting for 10 sec followed by 5 sec pause.
	10 sec Continuous	F7 Impulse counting for 10 sec continuous.
	IF Geiger-Müller module is installed, the following is added:	

GM Continuous	Shift F2: GM Continuous impulse counting.
GM 1 sec	Shift F3: GM Impulse Counting for 1 sec
GM 6 sec	Shift F4: GM Impulse Counting for 6 sec
GM 10 sec	Shift F5: GM Impulse Counting for 10 sec
GM 60 sec	Shift F6: GM Impulse Counting for 60 sec
GM 10 sec + 5 sec Pause	Shift F7: GM Impulse counting for 10 sec followed by 5 sec pause.
GM 10 sec Continuous	Shift F7: GM Impulse counting for 10 sec continuous.

Start A - Stop B	Measures Run Time from A to B .
Pass Time	Measures Pass Time for A and B . (Up to 9 times per channel).
Pass / Run time	Measures Run Time from A to B and the Pass Time for A and B .

Technical Information

Mains supply

230 V AC $\pm$ 10% 50 Hz 20 VA

Input A and B

Input impedance 500 kOhm
Sensitivity 200mV
Trigger polarity positive going or negative going, individually selectable in each function if relevant

Frequency

Range 0.01 Hz - 99.9 kHz
Resolution 0.01 Hz - 10 Hz dependent on the input signal
Method Continuous measurement
Single measurement
Pendulum - continuous measurement
Pendulum - single measurement

Period

Range 0.01 Hz - 99.9 kHz
Resolution 0.01 msec - 10 msec dependent on the input signal
Method Continuous measurement
Single measurement
Pendulum - continuous measurement
Pendulum - single measurement

Impulse Count

Range 0 - 9999 impulses per second
Resolution 1 impulse
Method Continuous counting
Counting for 1 second
Counting for 6 seconds
Counting for 10 seconds
Counting for 60 seconds
Counting for 10 sec followed by 5 sec pause
Counting for 10 sec continuous

Start A - Stop B

Range 0.01 msec - 100 sec
Resolution 0.01 msec

Pass Time

Range 0.01 msec - 100 sec
Resolution 0.01 msec
Method Simultaneous on both channels
Memory Up to 9 times per channel

Pass / Run Time

Range 0.01 msec - 100 sec
Resolution 0.01 msec
Method First pass time on **A** and then pass time on **B**.
Memory One set of measurements. (Run Time A to B, Pass Time A and Pass Time B)